Otto, Alkis Henri

Research Report

Implications of rising energy and transportation costs for future urban development: Inner city trends in Hamburg

HWWI Policy Paper, No. 1-25

Provided in cooperation with:
Hamburgisches WeltWirtschaftsInstitut (HWWI)

Suggested citation: Otto, Alkis Henri (2010) : Implications of rising energy and transportation costs for future urban development: Inner city trends in Hamburg, HWWI Policy Paper, No. 1-25, http://hdl.handle.net/10419/47694

Hamburg Institute
of International
Economics

Implications of rising energy and transportation costs for future urban development: Inner city trends in Hamburg

Alkis Henri Otto

HWWI Policy
Paper 1-25
by the
HWWI Research Programme
Hamburg and Regional Development

Hamburg Institute of International Economics (HWWI) | 2010
ISSN 1862-4960

Dr. Alkis Henri Otto
Hamburg Institute of International Economics (HWWI)
Heimhuder Str. 71 | 20148 Hamburg | Germany
Phone +49 (0)40 34 05 76 - 332 | Fax +49 (0)40 34 05 76 - 776
otto@hwwi.org

HWWI Policy Paper
Hamburg Institute of International Economics (HWWI)
Heimhuder Str. 71 | 20148 Hamburg | Germany
Phone +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 776
info@hwwi.org | www.hwwi.org
ISSN 1862-4960

Implications of rising energy and transportation costs for future urban development: Part III – the local view

Inner city trends in Hamburg

Alkis Henri Otto

The subsequent report is Part III of a research project which is realized in cooperation with alstria office REIT AG.

(See HWWI Policy Papers 1-14 and 1-17 for the first part and HWWI Policy Papers 1-23 and 1-24 for the second part of the research project)

1. Introduction

At an aggregate level economic structures are driven by the interaction between trade and transport costs on the one hand and costs reductions of large scale production (in industries with increasing returns to scale) on the other hand.

While cities are embedded in this complex structure and, hence, are influenced by macro trends and changes in national and international trade patterns the new economic geography framework's power to explain the development of urban structures is rather limited. There are several reason for this. First of all the economic structure of modern cities is often dominated by the service sector. As a consequence the interaction of spreading and concentration forces discussed in studies #1 and #2 of this series do apply only to a limited extent because many services are a) not tradable or b) part of the *weightless economy* where telecommunication is the main mode of transport and overland transport and energy cost play a minor role.

A second point is that a chief difference between large regions and cities is the scarcity of land in agglomerations. Therefore setting up new plants in cities often leads to a number of conflicts and problems. As a consequence urban structures are very persistent and a quick restructuring of urban land use is almost impossible. One reason is that due to the high value and longevity of capital stocks like infrastructure or real estate the costs of reallocating land in cities are often prohibitive. Furthermore, urban land use is heavily regulated by laws and rights of its inhabitants. For instance, pollution acts restrict inner city industry activities and the kinf of use of scarce urban space often is under political control. Moreover, in many cases, the law protects the rights of residents and, thereby, preserves city structures.

However, the patterns of urban land use are not solely influenced by regulations and path dependencies. They are also driven by economic processes which are explained by another class of models. In these models residents or households are confronted with a tradeoff between the proximity of their homes and their work places, heterogenous local amenities at their palce of residence, and differences in housing prices. In order to benefit from lower housing prices and less traffic in the urban fringe many residents (employees) are often willing to accept higher expenses for commuting. Commuting patterns, of course, are influenced by rising energy prices such that the location of residential areas will may change in the long run. Another important factor for the future of urban land use is the demographic structure of the population and the related population dynamics and trends. In an aging society like Germany the ratio of the labour force to overall residents is expected to change dramatically in the next decades. This development will alter the inner city transport and commuting patterns in many metropolitan areas significantly.

The focus of this study is on the consequences of rising energy costs and demographical change in the city of Hamburg. In section 2 we present a class of models that help to understand and explain patterns of urban land use. Section 3 then discusses urban land use and the population structure of Hamburg. Section 4 addresses some future economic and

demographic trends and relates them to rising energy costs. Section 5 finally highlights some conclusion drawn from the analysis.

2. Models of urban land use

What determines city structure, i.e. the distribution and location of commercial areas and housing areas in urban space? If we wish to understand current patterns of urban land use in cities we have to distinguish several factors that have shaped and still shape the urban landscape. Some factors are individual and city specific, others are more general events that are relevant to many cities. Individual factors encompass historical fortuities as well as path dependencies, geographical characteristics and (discretionary) political decisions. A lot of those factors, especially geographical factors, are immediately apparent to the eye. Others like the impact of wars or natural disasters on the city structure are often only visible at second sight or for the initiated. But apart from those important individual, city specific factors, there is a set of more general, universal mechanisms that carves the landscape of metropolitan areas worldwide. Metropolitan space is scarce and competition on urban land markets in combination with differences in willingness to pay lead to efficient and often typical patterns of land use in many places.

A class of models that explores those mechanisms and helps to explain some of the patterns observed are the *Alonso-type models of urban land use*. As already discussed in study #2 the allocation of land in urban areas can be modelled as the result of a utility maximizing behaviour of households. The pioneering work in this field was the model of Alonso (see Alonso 1964) which was heavily influenced by von Thünen's bid rent model for land use in agricultural economies. At the core of the Alonso model is a highly stylized urban system where the central business district (CBD) is located in the city centre. Households compete for land on a perfectly competitive market, where the right to use land in a particular distance to the CBD is given to the highest bidder. All economic activity takes place in the CBD and, therefore, all individuals have to commute from their site to the CBD. Commuting costs are the higher the greater the household's distance to the CBD. As a consequence, assuming homogenous households, the model predicts that bid rents – the maximum price for land households are willing to pay – decline with distance to the CBD.

In the meantime Alonso's model has undergone many revisions and modifications. Residential zones are just one form of urban land use. More sophisticated versions of the model also try to explain the location of shopping and service zones and industrial zones. Here an important result is that companies are willing to offer the highest rent for land close to the CBD, which explains why in most cities the city centre usually hosts office buildings and shopping streets. Another refinement of Alonso's basic model deals with issues related to urban land use for residential zones. In a first step Muth (1969) shifted the focus from urban land use to the urban

housing market. Later, the model was modified and enriched by various topics. For instance, some models considered various types of commuting costs. Most obviously commuting costs consist of direct cost for covering the distance from residential zones to the CBD. The second kind of costs associated with commuting is opportunity costs. The reason is that commuting takes time and therefore employees, while commuting, cannot work. So here opportunity costs equal foregone labour income.

Another branch of refinements considers demographic factors and income differences. Concerning social differences these models predict that high income or relatively rich households will locate in greater distance to the city centre because commuting costs are relatively small for them.

Demographic differences between households usually are most visible for the family status of residents. If one assumes that family households have a stronger preference for green amenities and nature (or, put differently – less traffic) the models predict that families should settle down in greater distance to the CBD where supply of green space is relatively abundant even though this increases commuting costs. On the contrary, single or two-person households should locate in proximity to the CBD where they find more cultural and recreational opportunities. An exception is the subgroup of single or two person households that once were family households (3 or more persons). Typically children leave their family and move to another place when their parents are in their fifties and usually their parents stay in their homes. If the influence of demographical characteristics on location patterns of residents is stable this approach will probably help us to understand and predict some future developments of urban structure considering regional demographic forecasts.

3. City structure and urban life in Hamburg

Hamburg, the second biggest city in Germany, is the home town of 1,73 million inhabitants. The area of Hamburg comprises 755 km^2 and is politically divided into seven boroughs. Though Hamburg has a more than 1250 years old history the city of Hamburg as we know it today was formed only 70 years ago. In 1937 a district reform (the so called "*Groß-Hamburg-Gesetz")* forged the cities *Hamburg, Altona, Bergedorf, Harburg/Wilhelmsburg*, and *Wandsbeck* as well as the *Landkreis Hamburg* to what is known in these days as Hamburg. Today these once independent cities are still identifiable as small political and economical entities within Hamburg. They correspond largely to Hamburg's boroughs and, still, many important political decisions (concerning decisions on urban land use) are being made by local parliaments and local authorities. Economically, urban structures have changed substantially over the last decades and historic structures and old industries are less visible. This was clearly caused in general by the enormous structural shift that altered the economic landscape of western cities.

Table 1

Population by boroughs 2008

Boroughs	Population	as a % of overall pop.	Population Density (pop. per km^2)	Employees*
Hamburg-Mitte	281472	16.2	1989	91008
Altona	250223	14.4	3175	80301
Eimsbüttel	242699	14.0	4893	86670
Hamburg-Nord	279285	16.1	4857	108919
Wandsbek	409407	23.6	2772	133817
Bergedorf	118910	6.9	769	41148
Harburg	153667	8.9	1226	49874
Hamburg	1735663	100.0	2298	591737

* covered by social security, place of residence

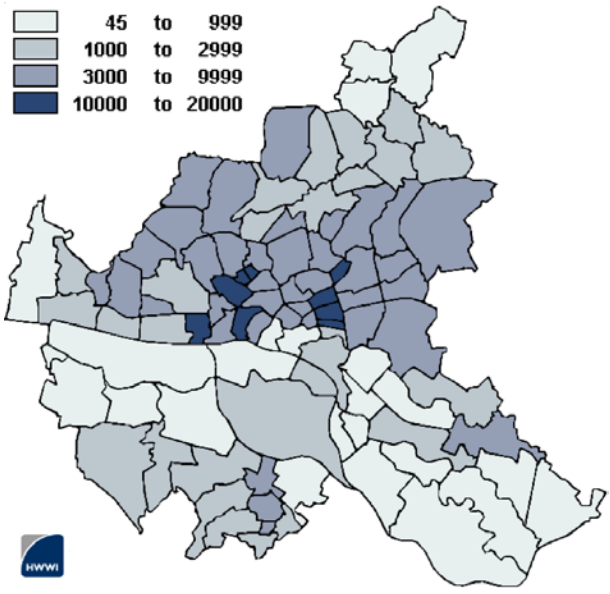
Source: Statistikamt Nord (2009a).

However, often the centre of the once independent cities is still quite distinct and often hosts large retail and shopping areas.

Geographically, the river Elbe and a number of smaller streams and town canals like the Alster or the Osterbekkanal determined the location of industries for many decades. While town canals are no longer a location factor, the Elbe remains an important waterway for the city of Hamburg. The harbour and related industries occupy large parts of the city centre.

A characteristic feature of Hamburg is its relatively low population density. On average we find 2 300 residents per km^2. In contrast average population density in Berlin is 3 800 residents per km^2 and population density in New York City is 10 500 residents per km^2. Table 1 shows that even within Hamburg the differences in population density are substantial.

Figure 1: Population Density (pop. per km^2) 2007



Source: Statistikamt Nord (2009a), HWWI's calculations.

Fig. 1 depicts population density in Hamburg's districts. It visualises (a) that the population concentrates in the north of the city. In contrast population density in the south of Hamburg is relatively low. Another interesting aspect again is (b) the difference in population density across districts. While the district Hoheluft-West had a population density of 18 400 residents per km^2 in 2007 other districts like Neuengamme or Neuland/Gutmoor had densities below 200 residents per km^2. However, the data depicted by Fig. 1 shows that there is ample space for further development in the south of Hamburg. But even in some parts in the north of Hamburg there is enough room for a possible redensification.

This finding is supported by the data on urban land use. Table 2 shows urban land use for the seven boroughs in Hamburg. Bergedorf and Harburg encompass 40 % of the area of Hamburg. In these two boroughs 64 % and 46 % respectively are used for agriculture or forestry (category "other"). This equals roughly 25 % of the overall area in the city of Hamburg. For the city of Hamburg as a whole more than one third (34.8 %) of space is used for this purpose.

Table 2

Urban land use in Hamburg 2006

Land use in km^2

Boroughs	Housing	Business	Mixed use*	Public use	Water	Other**	Fallow land	Overall
Hamburg-Mitte	11	20	1	32	25	16	2	107
Altona	24	3	2	24	6	17	1	77
Eimsbüttel	19	3	2	18	1	6	1	50
Hamburg-Nord	16	4	2	28	2	6	1	58
Wandsbek	53	5	4	38	2	43	2	148
Bergedorf	13	3	1	23	12	99	3	155
Harburg	19	17	2	32	12	75	3	161
Hamburg	**155**	**54**	**14**	**195**	**61**	**263**	**13**	**755**

Land use as a percentage of area in boroughs

Hamburg-Mitte	10.1	18.3	1.2	30.2	23.3	15.0	1.9	100.0
Altona	30.7	3.6	2.8	30.8	8.3	22.5	1.3	100.0
Eimsbüttel	37.4	5.2	4.3	36.2	2.5	12.6	1.8	100.0
Hamburg-Nord	27.6	6.5	3.3	48.3	3.2	9.5	1.5	100.0
Wandsbek	36.1	3.4	2.7	25.7	1.2	29.3	1.6	100.0
Bergedorf	8.4	2.2	0.7	14.6	7.9	64.2	2.0	100.0
Harburg	12.0	10.8	1.0	20.2	7.6	46.8	1.6	100.0
Hamburg	**20.5**	**7.2**	**1.9**	**25.8**	**8.0**	**34.8**	**1.7**	**100.0**

Land use by borough as a percentage of land use in Hamburg

Hamburg-Mitte	7.0	36.1	9.0	16.6	41.1	6.1	15.5	14.2
Altona	15.4	5.1	15.2	12.2	10.5	6.6	8.1	10.3
Eimsbüttel	12.1	4.8	15.2	9.3	2.0	2.4	6.9	6.6
Hamburg-Nord	10.3	6.9	13.6	14.3	3.1	2.1	6.9	7.6
Wandsbek	34.4	9.1	28.3	19.4	2.9	16.4	18.6	19.5
Bergedorf	8.4	6.2	7.1	11.6	20.2	37.8	24.0	20.5
Harburg	12.4	31.8	11.5	16.6	20.1	28.6	20.1	21.3
Hamburg	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

* Housing and Business, ** mainly agriculture and forests

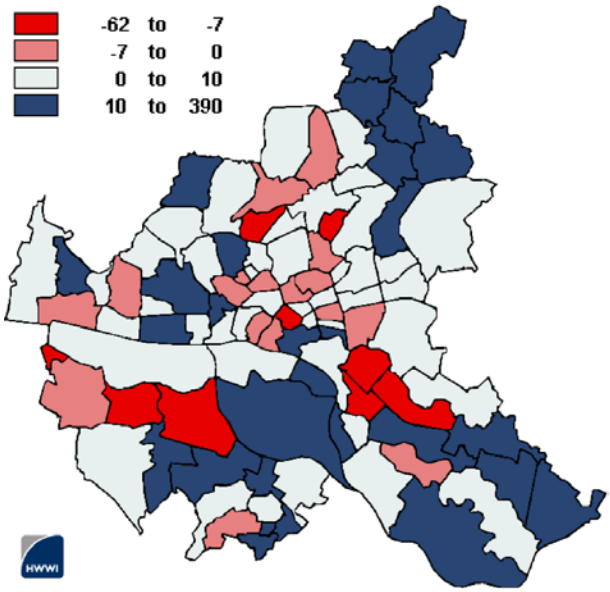
Source: City of Hamburg (Liegenschaftsregister), HWWI's calculations.

Space occupied for housing is one fifth of Hamburg's territory. Another remarkable fact from Table 2 is that only 7.2 % of Hamburg's area is used for business. Note that 36 % of commercial areas are located in Hamburg-Mitte, the city centre of Hamburg. Although the history of Hamburg and the data on land use indicate that Hamburg is not a monocentric city the concentration of land use for business purposes in the borough Hamburg-Mitte provides some evidence that the model of urban land use discussed in section 2 of this study is appropriate to describe at least to some extent the mechanisms at work in Hamburg.

Population dynamics within a city like Hamburg are complex. Usually we observe a manifold of different trends that interfere. What have been the population development trends in districts in recent years? Fig. 2 depicts population growth between 1987 and 2007. In the majority of districts (marked by light blue and light red texture) the number of residents has been relatively stable over the past 20 years. At first glance there seems to be no pattern for population growth that can be explained by economic models. A reason for this is that in many cases population growth in Hamburg's district was actually driven by political decisions. For instance, population grew in districts where the supply of dwellings rose sharply due to strong construction activity. The districts Bergstedt (+27 %), Lemsahl/Mellingstedt (+57 %), and Duvenstedt (+81 %) as well as the other districts in the northern part of Hamburg called Walddörfer and the adjacent districts Farmsen/Berne and Sasel are vital examples for this process. At the same time population has shrunk in districts where either new industrial activities where established or old industries like the airport in Fuhlsbüttel have shaped living conditions and the cityscape in adjacent districts substantially. Consider for example districts in the south-west of Hamburg marked by dark red colour. Here major industrial projects like EADS/Airbus and the Containerterminal Altenwerder lead to or supported a depopulation in the districts Francop (-12 %) and Altenwerder/Moorburg (-24 %). Another possible source of shrinking numbers of residents in districts is social circumstances. For instance, St. Georg (-15 %) and Steilshoop (-10 %) observed declining population numbers from 1987 to 2007.

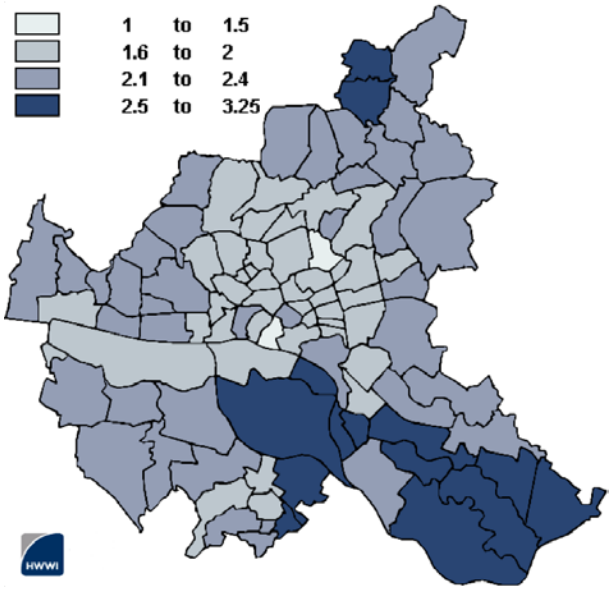
Next consider average household size (Fig. 3). Here we find that singles and couples concentrate in districts close to the city centre while we find larger households closer to suburbia. Obviously families live in suburban districts. The latter is also supported by the share of different age groups in Hamburg's districts.

Figure 2: Population Growth in %, 1987-2007



Sources: Statistikamt Nord (2009a), HWWI's calculations.

Figure 3: Household size 2007



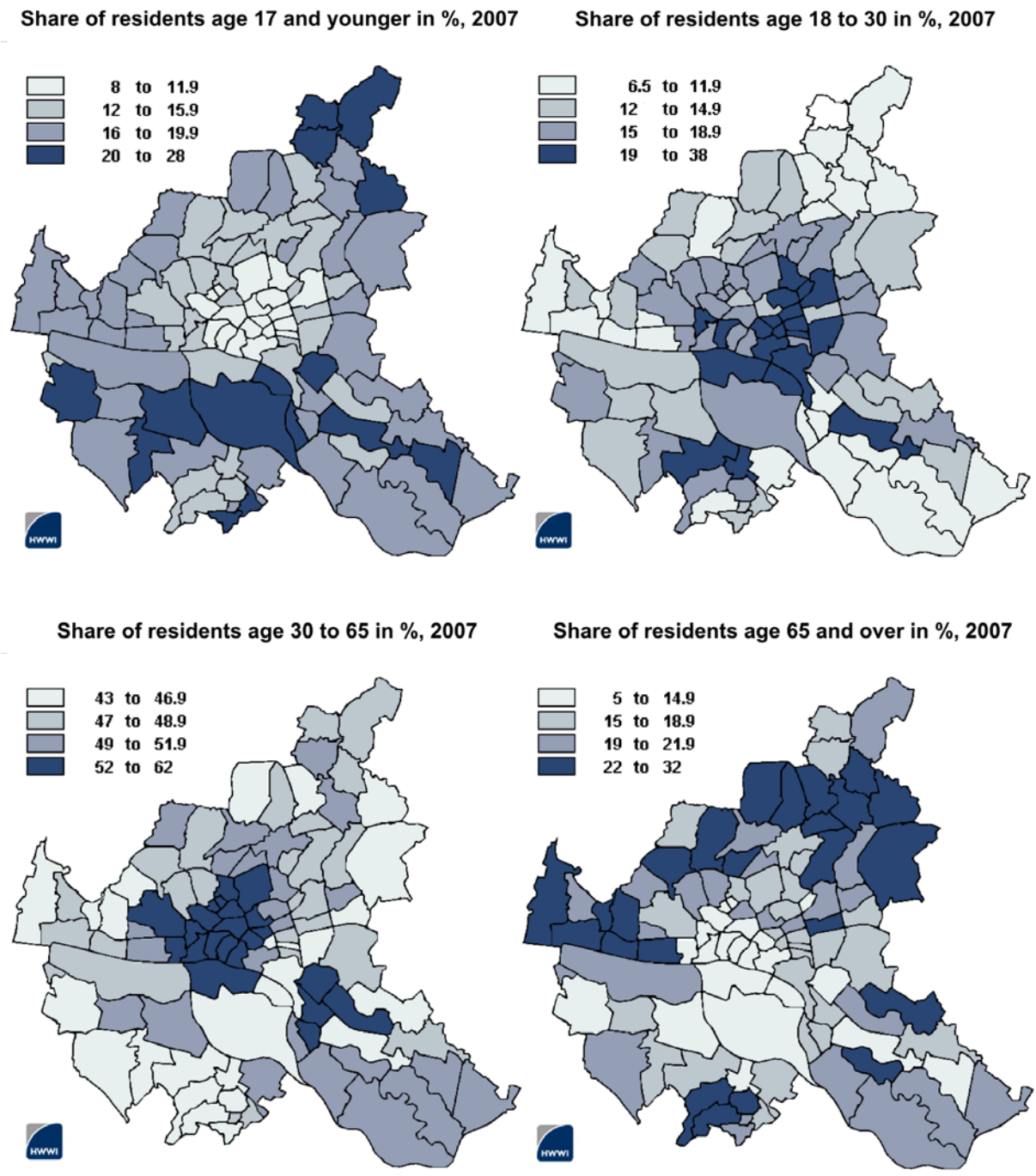
Sources: Statistikamt Nord (2009a), HWWI's calculations.

Note that the share of minors is relatively low in districts close to the city centre (see Fig. 4, upper left panel). The fact that minors usually live with their family fits the prediction made by the model that families tend to settle in greater distance to the CBD. Furthermore the theory is also supported by migration data which shows that on aggregate Hamburg has lost families to its outskirts (see Analyse und Konzepte 2007) where housing is more affordable.

Fig. 4 (lower right panel) depicts the share of citizens of age 65 and over. Again we see that relatively old citizens concentrate in districts with greater distance to the city centre. The underlying causes for this pattern become clearer if we consider the right panel in Fig. 5 that shows the change in share of residents age 65 and over. Over the past twenty years the share of pensioners declined in districts close to the city centre and increased in the outer districts of Hamburg. A closer look at the data reveals that this is simply an outcome of an aging society. A large fraction of the relatively old still occupies the same houses in the urban fringe where they moved with their families when they were younger. Also very distinct is the decline of the share of residents age 65 and over in districts close to the city centre. Here we have two reasons for this. The first reason is that over the last twenty years residents of this age group died and their dwellings were occupied by younger residents and the second reason is that today residents of the age group 65 and over prefer not to live in districts close to the city centre.

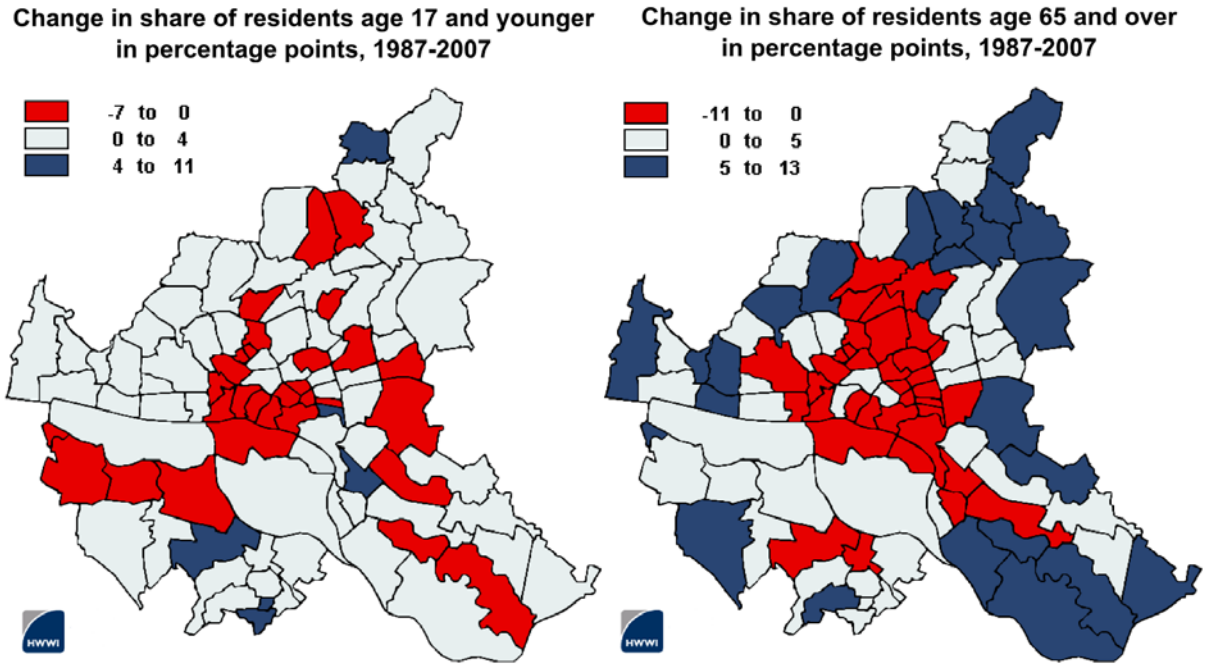
Since minors and pensioners tend to locate closer to the urban fringe by simple logic the age cohorts between 18 and 65 years have to live closer to the CBD. Furthermore we should expect household size to lessen with proximity to the CBD (as is confirmed by Fig 4). Fig. 4, upper right panel shows the share for the age groups 18 to 30 years (mainly students and apprentices) and 30 to 65 years. As argued before both figures reveal that these groups preferentially occupy districts in the city centre. However, members of the younger age group settle in districts in the east of the city centre while members of the older age group prefer the west of the city centre. The reason for this separation lies in the height of rents which tend to be cheaper in the eastern part of the city centre (see LBS 2007) and are, hence, more affordable for younger people.

Figure 4



Sources: Statistikamt Nord (2008, 2009a).

Figure 5



Sources: Statistikamt Nord (2009a), HWWI's calculations.

Table 3 shows the distribution of companies that are members of the Hamburg Chamber of Commerce by sector and location (borough). There are two different kinds of companies: firms registered and firms not registered in the commercial register. The latter are usually small businesses. The data shows that firms that are registered in the commercial register are concentrated close to the city centre in the borough Hamburg-Mitte. Their (overall) share is 39 %. Again this is an indication that the model of urban land use might provide some information about the forces that shape the urban landscape. If we compare the distribution of firms with the distribution of the population (Table 1) the empirical evidence suggests that we can expect a large share of commuters to commute to Hamburg-Mitte.

Table 3 also reveals that firms not registered in the commercial register (small businesses) play a relatively large role in the other boroughs of Hamburg. Here the distribution of firms across boroughs is rather disperse. This corresponds to fact that the share of mixed land use (Business and Housing, see Table 2) is also relatively high in those parts of Hamburg.

Table 3

Members of the Hamburg Chamber of Commerce (firms) by boroughs and sector, as a percentage of the total number of firms, 2009

Firms registered in commercial register (total no. of firms: 56516)

Boroughs	Agriculture, Forestry and Fishery	Industry	Trade	Transport, Communication and Information Transmission	Other services	Overall
Hamburg-Mitte	0.0	2.6	7.9	9.2	19.2	**39.0**
Altona	0.0	1.3	3.1	4.1	7.5	**16.0**
Eimsbüttel	0.0	1.1	3.0	1.7	6.5	**12.3**
Hamburg-Nord	0.0	1.0	3.4	1.9	6.9	**13.1**
Wandsbek	0.0	1.3	4.2	1.3	6.4	**13.2**
Bergedorf	0.0	0.3	1.0	0.3	1.0	**2.7**
Harburg	0.0	0.4	1.1	0.5	1.6	**3.6**
Hamburg	**0.1**	**8.0**	**23.6**	**18.9**	**49.4**	**100.0**

Firms not registered in commercial register (total no. of firms: 87036)

Boroughs	Agriculture, Forestry and Fishery	Industry	Trade	Transport, Communication and Information Transmission	Other services	Overall
Hamburg-Mitte	0.0	1.2	4.2	2.6	9.7	**17.7**
Altona	0.0	0.6	3.2	2.2	8.5	**14.5**
Eimsbüttel	0.0	0.5	3.5	2.2	9.8	**16.0**
Hamburg-Nord	0.0	0.7	4.2	2.6	11.3	**18.8**
Wandsbek	0.0	0.9	5.5	3.1	11.8	**21.3**
Bergedorf	0.0	0.3	1.6	0.8	2.8	**5.5**
Harburg	0.0	0.5	1.6	0.8	3.2	**6.2**
Hamburg	**0.1**	**4.8**	**23.7**	**14.3**	**57.1**	**100.0**

Sources: Handelskammer Hamburg (2009), HWWI's calculations.

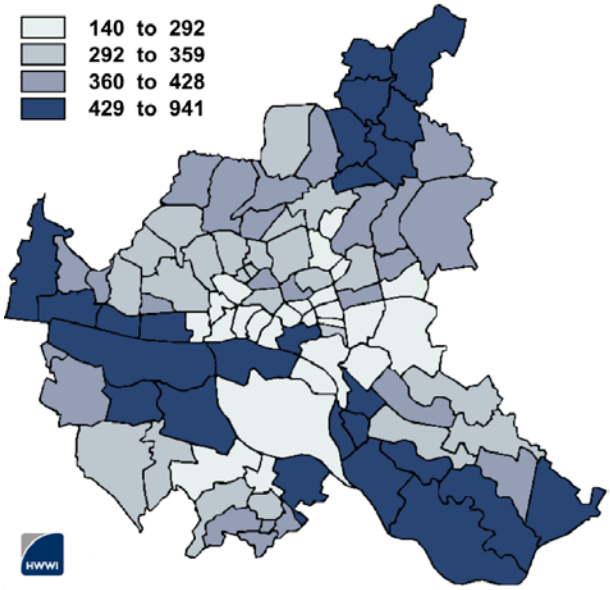
4. Future trends and projections

4.1 Rising energy costs and urban living

Though Hamburg has a very capable public transport system cars are still an important mode of transport for commuters. Fig. 6 shows the number of cars per 1000 citizens in the districts of Hamburg. Cars compete with public transport for commuters. Therefore in districts which are well linked to the public transport system one should observe fewer cars per resident. Districts in the south of the river Elbe have greater number of cars per citizen than districts in the north. Apart from that, with a few exceptions, distance from the city centre seems to explain a fraction of the distribution. There are two reasons for this: First those districts are often more spacious and population density is relatively low. Second, as already mentioned, income and wealth of households are increasing with distance to the city centre such that households that live in the periphery can afford more vehicles.

As pointed out in study #1 (Ott et al. 2009) prices for energy resources are likely to soar in the next years and decades. While this will certainly lead to higher prices for gasoline the overall effect on commuting costs also depends on technical progress in the automobile sector. Here the development of more fuel efficient cars and of new technologies like electric cars works into the opposite direction.

Figure 6: Cars per 1000 citizens by district 2007



Source: Statistikamt Nord (2009a).

Another important factor that may help to mitigate the effects of rising energy costs on commuting costs in agglomerations is the future of public transport. Public transport serves as a substitute for individual and automotive transport. Moreover, it is also an important alternative in the context of global climate change. Given the projected scenarios for global warming and the fact that transport is one of the primary energy consumers local authorities will possibly strengthen the role of public transport systems to reduce CO_2 emissions. However, if the effect of soaring energy prices on commuting costs dominates other cost reductions the theory of urban land use predicts that this will increase the relative importance of commuting costs and, hence, will give households an incentive to move closer to their work places.

While the overall effect of rising energy prices on urban transport and household location remains to be seen energy prices as well as global climate change will certainly require a significant change in architecture and city planning. Here the modernising insulation of buildings and the construction of new energy efficient buildings will be of increasing importance. City planners will be confronted with the challenge to embed new public transport infrastructure into the existing townscape.

4.2 Economic environment

Though the industrial sector contributes a notable share to Hamburg's GDP the economic structure is dominated by service activities. A healthy 83 % of gross value added is produced within the service sector. Furthermore, 85 % of Hamburg's employees work in this sector (see Table 4).

Table 4

Production and Employment in Hamburg 2008

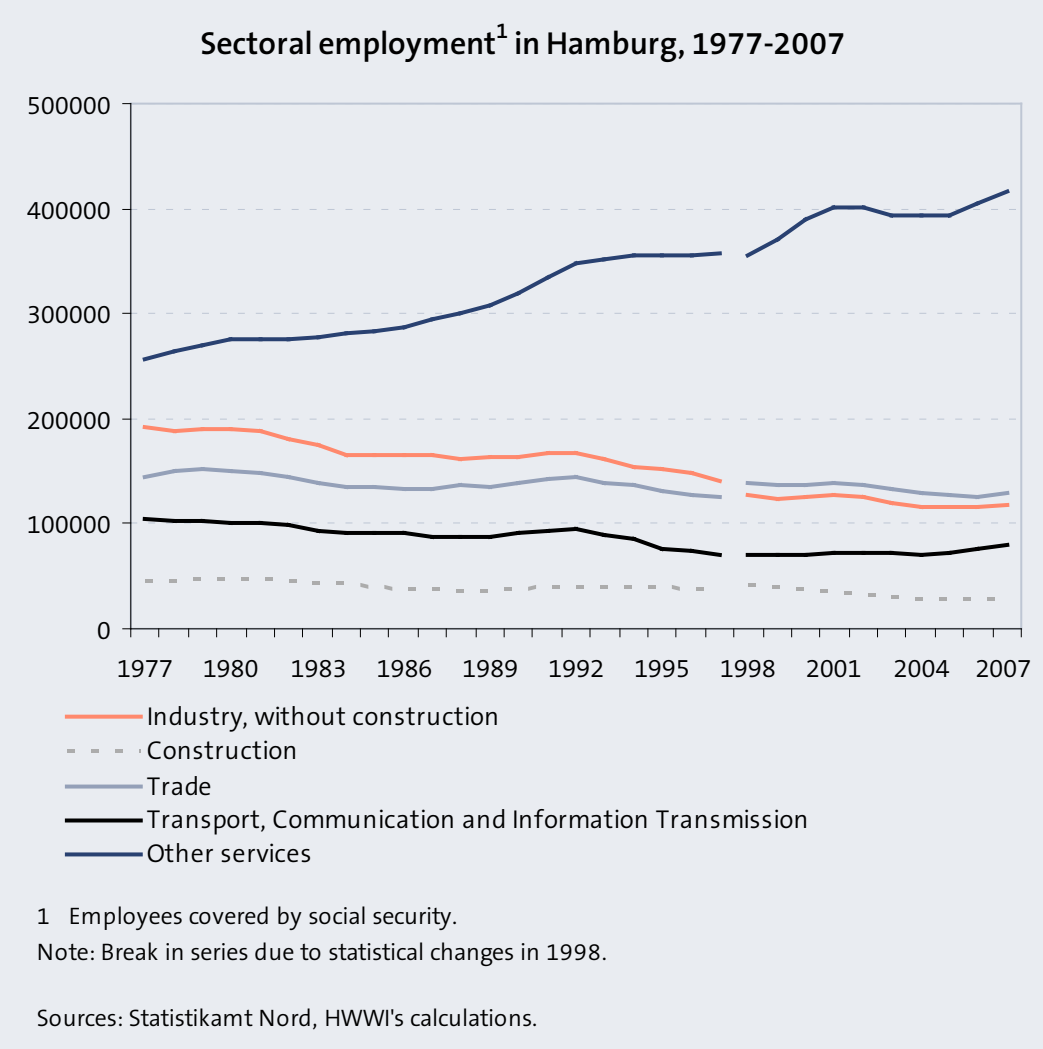
	Gross value added (GVA)	as a % of overall GVA	Employees	as a % of overall employment
	in million Euros		in thousands	
Agriculture, Forestry and Fishery	129	0.2	5.4	0.5
Industry (without construction)	11397	14.2	128.1	11.5
Construction	1784	2.2	36	3.2
Trade, Hotels and Restaurants, Transport	21709	27.0	327	29.3
Financial intermed., real estate and business services	30768	38.3	305.5	27.4
Public administration; compulsory social security	14547	18.1	312.2	28.0
Overall	**80334**	**100**	**1114.2**	**100**

Source: Statistikamt Nord (2009a).

Long term structural change is quite visible in the data for employment covered by social security which represents 70 % of overall employment (Fig. 7). Since 1977 employment covered by social security grew by roughly 30 000. However, the due to sectoral shifts employment has developed quite differently across sectors. Most notably, employment in the service sector increased from 256 000 employees in 1977 to 417 000 employees in 2007. In contrast the number of employees in the secondary sector (industry and construction) has declined over the past three decades. This decline in industrial activity is closely related to globalisation and the international reallocation of economic activities due to comparative advantages. Consequently, current industrial production in Hamburg and its metropolitan region focuses on capital and skill intensive, high quality and high tech manufactures like ships, aeroplanes and chemicals. Employment in the trade sector remained stable, whereas employment in the transport and communication sector decreased from 1977 to 1997 and has grown mildly in the last decade mainly because of the strong growth in container handling. Whether this branch will benefit from future growth in world trade and shipping depends on whether the port can manage to keep its position as a leading container hub in northern Europe. While the location of Hamburg 100 km east from the coast served to be an important advantage in the past decades the trend to larger container vessels with a deeper draught will possibly jeopardize Hamburg's stance as a distribution centre in international logistics if the city fails to adjust the fairway in the Elbe.

Though an increase in energy prices creates a strong incentive for firms to locate close to coast lines and ports as pointed out in study #1 of this series (Ott et al. 2009) a substantially higher share of the industrial sector in the composition of Hamburg's GDP seems to be unlikely. However, it will possibly occur outside of Hamburg in the metropolitan area. If Hamburg's port manages to keep track with technological developments in the shipping sector the city and its metropolitan region will very likely observe more logistics and distributions centres close to the harbour.

Figure 7



1 Employees covered by social security.
Note: Break in series due to statistical changes in 1998.

Sources: Statistikamt Nord, HWWI's calculations.

4.3 Demography

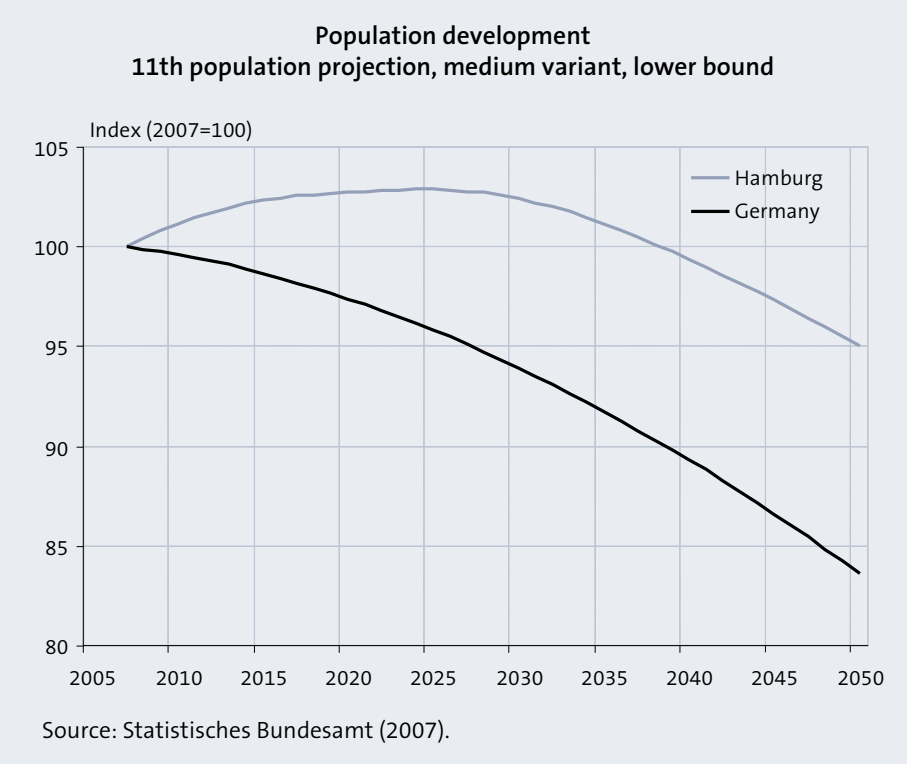
Fig. 8 depicts the results of the *11th coordinated population projection* (medium variant, lower bound) conducted by the German statistics agency. According to this projection population development in Hamburg will differ substantially from that in Germany in the next 15 years. While the size of the German population is already shrinking, the number of residents in Hamburg will increase till 2025 by roughly 3 %. After that it will decline moderately. For 2050 it

is expected that the number of residents in Hamburg will be 5% lower than in 2007. However, demographic change in Hamburg will be nonetheless severe in the next 15 years. This can be seen quite clearly in Fig. 9 which shows the age structure of Hamburg's residents in 2007 and as projected for 2020 in the *10th coordinated population projection*. Here the first finding is that the share of the age group between 18 and 30 years will be substantially lower in 2020. At the same time the age group 50 to 60 years will gain heavily in importance. The share of minors will be slightly lower than in 2007.

How does demographic change affect the labour force, i.e. the age group 15 to 65? In 2007 the share of residents of age 15 to 65 years was 68.9 %. In 2020 this age group is expected to represent 69.4 % of Hamburg's residents. Given the projected population growth this corresponds to an increase of the labour force of at least 40 000 persons. Nonetheless the demographic structure of the labour force will change dramatically and require a number of political activities and preparations (for details see Otto, Stiller 2009).

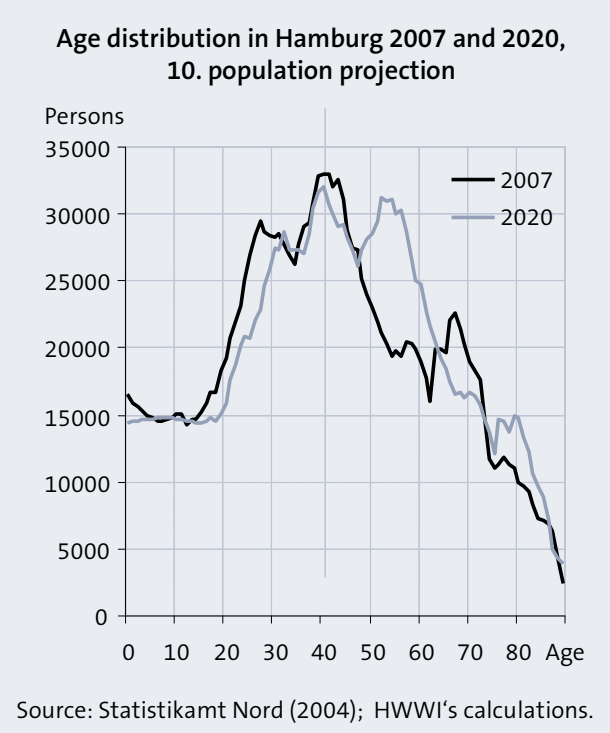
On the housing market these demographic shifts will probably also have consequences. Under the assumption that the preferences of age groups and the characteristics of Hamburg districts remain more or less constant we expect that the decline of the age group 18 to 29 years will lead to less demand for apartments in eastern downtown districts. However, note that the number of residents in age group 45 to 64 years will grow in absolute as well as in relative terms. Therefore, it is likely that residents of this age group will occupy more apartments in the eastern districts close to the city centre. At the same time families will be less represented in 2020. This will lead either to fewer housing demand in suburban districts or provide opportunities for families that – given current land and housing prices – locate in the outskirts of Hamburg.

Figure 8



Source: Statistisches Bundesamt (2007).

Figure 9



Source: Statistikamt Nord (2004); HWWI's calculations.

4.3 Urban Renewal: HafenCity and IBA 2013

The two urban construction projects HafenCity and IBA 2013 in Wilhelmsburg/Harburg will not only increase capacity in the city centre of Hamburg they are also a point of inflexion for the spatial development concept in Hamburg. Before those projects, an expansion of the city was considered to take place along the major traffic arterials that connect the city centre with the rural areas of the metropolitan region. The strategy or blueprint for an expansion was the so called "Fächerplan" developed in the 1920's by Hamburg's city planner Fritz Schumacher. With the realisation of the HafenCity and the IBA 2013 the focus was shifted towards the city centre (Walter 2007). As a result of this paradigm shift population growth in the metropolitan area Hamburg might lead to a higher population density within the city of Hamburg.

The new district HafenCity will provide residential space for 12 000 residents in roughly 5 500 apartments. Though it is expected that families will reside in the HafenCity it is very likely that according to current location patterns and population trends the HafenCity will be occupied mainly by singles and couples. Overall, the effect of the HafenCity on the housing market in Hamburg will be very limited. This is because of the relatively small number of apartments constructed in this district (less than 1 % of the existing housing units in Hamburg within the next 10 to 15 years).

In contrast, HafenCity is expected to have a considerable impact on the office market. According to the HafenCity master plan working space for 40 000 people will be constructed, roughly 90 % of these are expected to work in offices (see HafenCity Hamburg GmbH 2006). Given the projections for population development in Hamburg this project provides the lion's share of additional working space needed till 2025.

The IBA 2013 in Wilhelmsburg tries to pursue two different missions. First it is an integral part of "*the leap across the Elbe",* a pioneering step to develop the southern parts of Hamburg. Second, the IBA traditionally serves as a laboratory for contemporary problems and solution concepts in the field of architecture and city planning. In Hamburg the IBA tackles questions and issues like global climate change and climate friendly urban development as well as urban society and migration. Furthermore, it tries to find answers on how urban planning can help to master the structural shift from industrial to knowledge based economic activities. All of those issues are of great importance for many cities but also for Wilhelmsburg itself that suffered from a storm flood 50 years ago, that hosts a large share of migrants and relatively poor residents and whose economic structure and land use still shows remnants of industrial and agricultural activities.

Overall, HafenCity and the IBA 2013 will boost urban development in Hamburg's city centre and strengthen its importance. As a consequence, the mechanisms described in the model of the monocentric city might gain in importance, too.

5. Conclusions

The consequences of rising energy costs for cities are twofold. First of all, cities are affected because rising energy costs have an impact on the macroeconomic environment and international trade patterns. Furthermore, rising energy costs have substantial regional effects that originate in behavioural changes of local residents and firms that adjust consumption and production respectively to the new relative prices.

The macroeconomic effects on cities or agglomerations are related to the interplay of global concentration and spreading forces discussed in study #1. Here cities are affected because they are embedded in a complex international economic environment where energy prices and local geographic characteristics influence local transport and trade costs and, in combination with production technologies, have impacts on the agglomeration of industries. For Hamburg and mainly its metropolitan region the harbour and, hence, relatively low transport costs possibly remain an important location factor relevant to export industries. This will attract new or further industrial activities to the metropolitan region.

Concerning regional effects, rising energy costs will affect cities directly via housing and commuting costs and the resulting economic adjustment processes that lead to new patterns of urban land use and commuting. If rising energy costs exceed the cost reductions induced by future technological progress and the development of new transport systems we expect that a) households will locate closer to their work places which will result in a higher population density in Hamburg and that b) public transport systems will be of increasing importance to mitigate commuting costs and to protect the environment.

These long run effects will be accompanied by significant demographic shifts within the city of Hamburg. Given current population projections the number of residents in Hamburg will increase between 2007 and 2025 by roughly 3 % and decline afterwards by roughly 8 % till 2050. The latter corresponds to a decrease between 2025 and 2050 of roughly 140 000 residents. In addition to that the city will be confronted with on average aging residents.

The City of Hamburg has already responded to the projected population growth and, hence, the projected higher population density till 2025 by initiating two large city development projects, HafenCity and IBA 2013. Both projects will expand housing and office supply and, furthermore, strengthen the importance of the city centre. The new district HafenCity will provide the lion's share of additional working space needed till 2025.

An important issue for the city of Hamburg will be the consequences of shrinking population figures after 2025. Here two scenarios should be taken into consideration:

1) If the 11th population projection of the German Statistics Agency is correct the shrinking number of residents will lead to oversupply on housing and office markets. In this case city planners would have to think about strategies how to deal with lower population density and its consequences for city structure, i.e. the roles of the city centre, subcentres and

particular districts, the provision and funding of public transport and infrastructure, changes in commuting and land use patterns.

2) In the alternative scenario the population projection will turn out to be wrong. The reason for this could be that the projected demographic changes (less families and an aging society) will possibly lead to a higher housing demand close to the city centre and less demand in districts in suburbia. This would lead to price cuts for houses in the urban fringe and give families who currently prefer to settle outside of Hamburg the opportunity to acquire houses within the city. Rising energy and commuting costs would enforce this process.

Literature

Alonso, W. (1964): Location and Land Use: Toward a General Theory of Land Rent, Harvard University Press, Cambridge (MA).

Analyse und Konzepte (2007): Hansestadt Hamburg - Wohnstadt für Familien, LBS, Hamburg.

HafenCity Hamburg GmbH (2000): HafenCity Hamburg – The Masterplan, Hamburg.

Handelskammer Hamburg (2009): Zahlen 2008/2009, Hamburg.

LBS (2007): LBS-Immobilienmarktatlas 2007 – Hamburg und Umgebung, Hamburg.

Muth, R.F. (1969): Cities and Housing: The Spatial Pattern of Urban Residential Land Use, University of Chicago Press, Chicago.

Ott, I., Otto, A.H., Stiller, S. (2009): Implications of rising energy and transportation costs for future urban development – a global perspective, HWWI Policy Paper 1-14, Hamburg.

Otto, A.H., Stiller, S. (2009): Demografischer Wandel und Arbeitskräfteangebot: Perspektiven und Handlungsoptionen für hamburgische Unternehmen, HWWI Policy Report, Nr. 12, Hamburg.

Statistikamt Nord (2004): Bevölkerungsvorausschätzung für Hamburg bis 2020. Hamburg.

Statistikamt Nord (2008): Bevölkerung in Hamburg am 31.12.2007 – Auszählung aus dem Melderegister, Statistische Berichte, A I/S 1 – j/07 H, Hamburg.

Statistikamt Nord (2009a): Stadtteildatenbank, http://www.statistik-nord.de/fileadmin/regional/regional.php, Hamburg.

Statistikamt Nord (2009b): Bruttoinlandsprodukt und Erwerbstätige 1994 bis Arbeitsvolumen 2001 bis 2008 in Hamburg und in Schleswig-Holstein, Statistische Berichte, P I 1 (2) –j/08, Hamburg.

Statistisches Bundesamt (2007): Bevölkerung Deutschlands nach Bundesländern bis 2050 – Ergebnisse der 11. koordinierten Bevölkerungsvorausberechnung nach Ländern, Wiesbaden.

Walter, J. (2007): Perspectives of the Metropolis, in: Metropolis: Reflections, Ed. IBA Hamburg GmbH and Uli Hellwig, Jovis, Berlin.

HWWI Policy Papers
by the HWWI Research Programmes „Economic Trends“ and „Hamburg and Regional Development “

24. Entwicklungsperspektiven für die Stadt Hamburg: Migration, Pendeln und Spezialisierung
Amelie Boje, Ingrid Ott, Silvia Stiller, Hamburg, Januar 2010
23. Development perspectives for the City of Hamburg: Migration, commuting, and specialization
Amelie Boje, Ingrid Ott, Silvia Stiller, Hamburg, December 2009
22. Die Auswirkungen der Finanzkrise auf die deutschen Wohnimmobilienmärkte
Alkis Otto, Hamburg, November 2009
21. Einkommenseffekte von Erwerbsunterbrechungen – mit besonderer Berücksichtigung möglicher Elterngeldeinflüsse auf das Unterbrechungsmuster –
Christina Boll, Hamburg, November 2009
20. Das Machbare möglich machen
Thomas Straubhaar, Hamburg, September 2009
19. Einige Beobachtungen zum Pendlerverhalten in Deutschland
Sven Schulze, Hamburg, August 2009
18. Economic Impacts of Climate Change on Cities – A Survey of the Existing Literature
Georgios Stasinopoulos, Hamburg, August 2009
17. Implikationen steigender Energie- und Transportkosten für die künftige Stadtentwicklung – eine globale Perspektive
Ingrid Ott et al., Hamburg, Juni 2009
16. Hamburger Wirtschaft im Sinkflug
Michael Bräuninger, Eckhardt Wohlers, Hamburg, Juni 2009
15. Der Automobilmarkt in Deutschland
Michael Bräuninger, Daniel Schneider, Hamburg, Juni 2009
14. Implications of rising energy and transportation costs for future urban development – a global perspective
Ingrid Ott, Alkis Henri Otto, Silvia Stiller, Hamburg, Juni 2009
13. Wissen schafft Wachstum. Wirtschaftspolitische Handlungsoptionen für Innovation und Fortschritt
Henning Vöpel, Hamburg, Juni 2009
12. Altersvorsorge und Konsumverhalten von Frauen in Deutschland
Henning Vöpel, Hamburg, Mai 2009
11. Biokraftstoffe: Ziele, Chancen und Risiken
Michael Bräuninger, Sebastian Schröer, Sven Schulze,
Hamburg, Januar 2009
10. Das Bundeselterngeld- und Elternzeitgesetz in Deutschland: Analyse potenzieller Effekte auf Geburtenzahl und Fertilitätsstruktur
Nora Reich, Hamburg, Dezember 2008
9. Champions des Sports 2008 - Ein empirischer Vergleich deutscher Sportstädte
Max Steinhardt, Henning Vöpel, Hamburg, November 2008
8. Regionale Unternehmens- und Beschäftigungsdynamik
Michael Bräuninger, Friso Schlitte, Hamburg, Dezember 2007

7. Erbschaftssteuer – Abschaffen ist besser als revidieren
   Thomas Straubhaar, Hamburg, Dezember 2007
6. Gesundheitsentwicklung in Deutschland bis 2037 – Eine volkswirtschaftliche Kostensimulation
   Michael Bräuninger et al., Hamburg, Dezember 2007
5. Ökologische Steuerreform in der Schweiz
   Michael Bräuninger, Sven Schulze, Thomas Straubhaar
   Hamburg, Oktober 2007
4. Champions des Sports – Ein empirischer Vergleich deutscher Sportstädte
   Max Steinhardt, Henning Vöpel, Hamburg, Oktober 2007
3. Wirtschaftsfaktor Erdgasbranche
   Michael Bräuninger et al., Hamburg, August 2007
2. Auswirkungen von Strompreiserhöhungen auf Preise, Wachstum und Wettbewerbsfähigkeit
   Michael Bräuninger, Jörg Hinze, Norbert Kriedel, Henning Vöpel
   Hamburg, April 2007
1. Demographische Entwicklung: Problem oder Phantom?
   Sebastian Schröer, Thomas Straubhaar, Hamburg, November 2006

The **Hamburg Institute of International Economics (HWWI)** is an independent economic research institute, based on a non-profit public-private partnership, which was founded in 2005. The University of Hamburg and the Hamburg Chamber of Commerce are shareholders in the Institute .

The HWWI's main goals are to:
- Promote economic sciences in research and teaching;
- Conduct high-quality economic research;
- Transfer and disseminate economic knowledge to policy makers, stakeholders and the general public.

The HWWI carries out interdisciplinary research activities in the context of the following research programmes: Economic Trends, Hamburg and Regional Development, World Economy and Migration Research Group.

Hamburg Institute of International Economics (HWWI)

Heimhuder Str. 71 | 20148 Hamburg | Germany
Phone +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 776
info@hwwi.org | www.hwwi.org